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ELECTRIC POWER TOOL WITH LOCKING MECHANISM

BACKGROUND OF THE INVENTION

The invention relates to an electric power tool, especially to a hand-held circular saw, routing machine and the like, having a circular tool that is motor-driven by means of a shaft, whereby the tool can be clamped to the shaft by means of a clamping device that can be actuated by a clamping lever; having a mechanical braking device that, when activated, brakes the tool; a switching element to turn the motor ON and OFF; and a safety element which, when in a safety position, prevents the motor from being turned on and activates the braking device and which, when in a release position, allows the motor to be turned on and releases the braking device, whereby the braking device is mechanically connected to the safety element.

Electric power tools, especially hand-held circular saws of the type described above, use safety devices in order to prevent a user from improperly handling the hand-held circular saw. Especially electric power tools with circular tools such as, for example, hand-held circular saws, have such safety devices. When a motor is turned off by a switching element, a braking device brakes the tool, thereby preventing said tool from continuing to rotate without control. In this state, a safety element is in its safety position, thus preventing the motor from being turned on again by the switching element. In order to once again drive the tool with the motor, the user first actuates the safety element, which releases the braking device through a mechanical connection. Only in this release position of the safety element is the user able to turn on the motor by actuating the switching element so as to drive the tool via a shaft. In order to adapt the rotational speed of the tool to the motor, a gear can be installed, for example, between the motor and the tool.

Such an electric power tool is known, for example, from EP B1 444,909, with a motor-driven circular tool that can be clamped by means of a clamping device onto a

shaft that is connected to the motor. In order to brake the tool, the electric power tool has a mechanical braking device that is mechanically connected to a safety element. The safety element has a safety position in which it is not possible to turn on the motor and in which the braking device is activated. In the release position, the motor can be turned on and the braking device is released.

A drawback of the known device is that the rotating tool can still be uncoupled. Especially in order to save time, the user may be tempted, for example, to operate the clamping device while the tool is still rotating or while the electric power tool is switched on. This drawback exists especially in the case of tool-free clamping devices, and, for example, which components of the electric power tool can be damaged.

SUMMARY OF THE INVENTION

The present invention is based on the objective of further refining the clamping device of the electric power tool and the safety device in such a manner that improper handling by the user can be ruled out, even in the case of tool-free clamping devices. Furthermore, the solution should be cost-effective to manufacture.

According to the invention, this objective is achieved in that a locking mechanism is provided with which the clamping lever in its clamped state is unlocked in the safety position and locked in the release position.

Since the process of clamping and unclamping is already controlled on the clamping lever itself, a structurally simple and effective solution of the objective is possible. In particular, the user of the electric power tool will immediately notice that the clamping device is in the locked state. As a result of the mechanical coupling of the clamping lever with the safety element, by means of the locking mechanism, a reliable

locking in the clamped state in the safety position is ensured. Other mechanical solutions that act later in the effect chain of the clamping device are characterized by more complex engineering and consequently are less attractive in terms of their cost-effectiveness. In comparison to an electronic solution, the important advantage exists that the function is ensured, even in case of a power failure, in addition to which the electronic solutions are fundamentally less economical and less sturdy.

Advantageously, the locking mechanism has a hook element attached to the braking device so that, when the clamping lever is in its clamped state, said hook element can be fitted into a recess of the clamping lever and, in the locked state, said hook element grasps behind at least part of the edge of the recess, thus locking the clamping lever in the clamped state. By attaching the hook element to the braking device, when the safety element is actuated, the relative movement is transmitted directly for locking and unlocking the locking mechanism. The locking mechanism has a positive fit. With an electrically operated safety element, the hook element can also be moved by an actuator, for example, by a linear motor, that is controlled by the safety element. Since the hook element grasps behind the edge of the recess on the clamping lever, a stable locking is ensured by the positive fit between the clamping lever and the hook element. In order to achieve a greater path for the hook element in the area of the recess, the hook element can have, for example, at least one joint. An equivalent solution consists, for example, of arranging the hook element on the clamping lever and the recess on the braking device or of establishing the positive fit via an additional mechanical means through the relative movement of the braking device.

In a preferred embodiment, the recess is situated on an external pivoting range of the clamping lever so as to have the greatest possible distance from a pivoting axis of the clamping lever. If forces are exerted on the locked clamping lever from the outside, then an optimal distribution of the load on the locking mechanism is ensured. The closer the

locking mechanism is to the place where the force is exerted by the clamping lever, the less the load on the locking mechanism in case of improper operation. This minimizes the risk of failure of the locking mechanism.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be explained in greater depth below with reference to an embodiment. In the drawings:

Figure 1 is a perspective view of a locking mechanism according to the invention in a safety position;

Figure 2 is a perspective view of the locking mechanism shown in Figure 1 in a release position;

Figure 3 is a perspective view of a partial representation of the locking mechanism shown in Figure 1 with a clamping lever in the safety position;

Figure 4 is a perspective view of a partial representation of the locking mechanism shown in Figure 1 with a clamping lever in the release position.

DETAILED DESCRIPTION OF THE INVENTION

Figures 1 through 4 show an electric power tool according to the invention having a circular tool (not shown) that is driven by a motor, whereby said tool can be clamped to a motor-driven shaft **1** by means of a clamping device. In order to brake the tool, the electric power tool has a mechanical braking device **2** that is mechanically connected to a safety element **4** by an actuation part **5**. The safety element **4** has a safety

position in which it is not possible to turn on the motor and in which the braking device **2** is activated, as is shown especially in Figure 1. In a release position, the motor can be turned on by means of a switching element **3** and the braking device is released, which is especially clear from Figure 2.

The braking device **2** has a brake part **6** attached to the actuation part **5** and a brake drum **7** attached to the shaft **1**. When the safety element **4** is in the safety position, then the actuation part **5** is pushed essentially radially with respect to the shaft **1** by means of a spring **8** attached to the actuation part **5** by a screw **9**. In this position, the brake drum **7** and the brake part **6** are in contact with each other and, through the existing friction, they brake the tool via the shaft **1**. If the safety element **4** – in this embodiment, configured as a rocker switch – is pressed, then the actuation part **5** is pulled away from the shaft **1** against the force of the spring **8** and the safety element **4** is in the release position, as is shown especially in Figure 2. In the release position, the brake part **6** is not in contact with the brake drum **7** and thus the braking device **2** is inactive or released.

The locking mechanism according to the invention, which is shown especially in Figures 3 and 4, prevents an actuation of a clamping lever **12** needed to clamp the tool in the release position, as is shown especially in Figure 3. A bolt **15** supports the clamping lever **12** so that it can pivot about the bolt **15**, but the clamping lever **12** is fixed in the axial direction relative to the bolt **15**. The locking mechanism has a hook element **11** attached to the braking device **2** and, when the clamping lever **12** is in the clamped state, the hook element **11** can be fitted into a recess **13** of the clamping lever **12**. In the locked state, the hook element **11** grasps behind at least part of the edge **14** of the recess **13** and thus prevents pivoting of the clamping lever **12**. As a result, it is not possible for the user to actuate the clamping device. In an unlocked state, the hook element **11** is outside of the recess **13** and the clamping lever **12** can pivot freely.

The hook element **11** is arranged on the braking device **2** and relative to the recess **13** in such a way that the locking mechanism is locked when the safety element **4** is in the release position, and is unlocked when the safety element **4** is in the safety position. This means that the clamping lever **12** can only be actuated when the safety element **4** is in the safety position and thus the tool can be replaced, for example, by a user.